



# From Sun to Sunfish

Populations of organisms within a community compete with one another for limited resources, including food and habitat. This competition links them together in a complex interdependent web of relationships and limits the number and types of organisms an environment can support.

## Estimated Time

Five 50-minute class sessions

## Technology Tools/Skills Used in Chapter

Retrieving reliable information from the Internet and other media.

## Safety Precautions/Concerns

None

## Vocabulary

Abiotic  
Biotic  
Carrying capacity  
Community  
Compete  
Consumer  
Decomposer  
Energy pyramid  
Food chain  
Food web  
Habitat  
Invasive species  
Natural selection  
Niche  
Plankton  
Population  
Producer  
Trophic level

## Chapter Objectives

Students will be able to:

1. Explain how populations of organisms within a community compete with one another for resources and provide a specific example from an aquatic community in Missouri.
2. Recognize factors that affect the number and types of organisms an environment can support and provide a specific example from an aquatic community in Missouri.
3. Describe a specific example from an aquatic community in Missouri of each of the following: producer, consumer and decomposer. Explain the role each serves in the community.
4. Diagram and describe the transfer of energy in an aquatic food web in Missouri, including producers, consumers, decomposers, scavengers and predator/prey relationships.
5. Predict the possible effects of changes in the number and types of organisms in an aquatic community on the populations of other organisms within that aquatic community. Illustrate with specific examples from aquatic communities in Missouri.
6. Explain how a technological solution to a problem can have both benefits and drawbacks such as risks or unintended consequences. Illustrate with specific examples from aquatic communities in Missouri.

## Targeted Grade-Level Expectations

- EC.1.B.6.a. Identify populations within a community that are in competition with one another for resources**
- EC.1.B.6.b. Recognize the factors that affect the number and types of organisms an ecosystem can support (e.g., food availability, abiotic factors such as quantity of light and water, temperature and temperature range, soil composition, disease, competitions from other organisms, predation)**
- EC.2.A.6.a. Diagram and describe the transfer of energy in an aquatic food web and a land food web with reference to producers, consumers, decomposers, scavengers, and predator/prey relationships**
- EC.2.A.6.b. Classify populations of unicellular and multicellular organisms as producers, consumers, and decomposers by the role they serve in the ecosystem**
- EC.1.B.6.c. Predict the possible effects of changes in the number and types of organisms in an ecosystem on the populations of other organisms within that ecosystem**
- EC.1.D.6.a. Describe beneficial and harmful activities of organisms, including humans (e.g., deforestation, overpopulation, water and air pollution, global warming, restoration of natural environments,**

**river bank/coastal stabilization, recycling, channelization, reintroduction of species, depletion of resources), and explain how these activities affect organisms within an ecosystem**  
**IS.1.C.6.a.**

## Reference Material for Teacher Background

- DVD Compilation for *Conserving Missouri's Aquatic Ecosystems*
- Help Stop Aquatic Hitch Hikers (FIS002)
- Introduction to Crayfish (FIS011)
- Introduction to Fishing (FIS152)
- Introduction to Missouri Fishes (FIS020)
- Know Missouri's Catfish (FIS003)
- Life Within the Water (FIS034)
- Map: Smallmouth Bass (FIS019)
- Map: Trout Fishing In Missouri (FIS210)
- Missouri Marsh Birds (E00042)
- Missouri Toads and Frogs (E00430)
- Missouri Turtles (E00468)
- Missouri Wetlands & Their Management (SCI150)
- Nuisance Aquatic Plants in Missouri Ponds and Lakes (FIS110)
- Poster: Exploring Missouri Wetlands (E00003)
- Poster: Missouri Fishes (E00013)
- Poster: Missouri Pond Life (E00002)
- Poster: Missouri Stream Life (E00016)
- Poster: Rivers and Streams: Missouri Currents (E00509)
- Poster: Salamander (E00089)
- Poster: Toads & Frogs (E00012)
- Poster: Wetlands & Waterfowl (E00115)
- Zebra Mussels: Missouri's Most Unwanted (FIS013)
- *Crayfishes of Missouri* (01-0250)
- *Fishes of Missouri* (01-0031)
- *Amphibians and Reptiles of Missouri* (01-0190)
- *Missouri Naiads* (01-0150)
- *Pond Life: Revised and Updated (A Golden Guide from St. Martin's Press)* by George K. Reid

## Required Materials

- Poker chips: two red, two white and two blue chips for each student (3 × 3 inch squares of construction paper may substitute if doing this activity indoors.)
- Sufficient space for students to stand arm's distance apart from one another
- DVD Compilation for *Conserving Missouri's Aquatic Ecosystems*
- Missouri Fishes poster (E00013)
- Know Missouri's Catfish (FIS003)
- Introduction to Missouri Fishes (FIS020)
- *Fishes of Missouri* (01-0031)
- TV/DVD player
- Adhesive tape (e.g., Scotch or cellophane)
- One copy of Missouri Fish and Their Characteristics page 2 for each student
- One copy of Missouri Fish and Their Characteristics page 3 for each student
- *Aquatic Community Food Web Scramble* information card for each species (Advanced preparation is required.)
- *Aquatic Community Food Web Scramble* name tag for each species (Advanced preparation is required.)
- Three 6-foot-long strands of yarn or cord per student (Advanced preparation is required.)
- Notebook paper
- Pens or pencils
- Computer with internet connectivity (optional)

# Activity 5.1: Exploration of Students' Current Understanding of the Interactions of Populations within Communities

This activity explores students' current understanding of the interactions of populations within communities.

## Estimated Time

10 minutes

## Required Materials

None

## Procedure

1. Use a cooperative learning activity to explore the following questions:
  - What do you need to survive? Which needs are most urgent?
  - How do you get those needs met in your daily lives?
  - What would happen if one or more of the things you need were in much shorter supply?
2. Explain to the class that this chapter will help them understand how fish and other aquatic species interact to get the things they need to survive.

# Activity 5.2: Student Simulation of Competition within a Community

*Adapted from “Every Fish for Itself” by Melanie Carden-Jessen and Mary Scott, Missouri Department of Conservation*

Students play a simulation game to help them understand the concept of competition for basic survival needs. The activity introduces the concept of habitat.

## Estimated Time

40 minutes

## Required Materials

- Poker chips: two red, two white and two blue chips for each student (3 × 3 inch squares of construction paper may substitute if doing this activity indoors.)
- Sufficient space for students to stand arm’s distance apart from one another

## Procedure

1. Tell students that they’ll be playing a game called “Every Fish for Itself.” The object of the game is to gather as many poker chips as possible. Explain that each student represents a fish and each poker chip represents something fish need to survive. Blue represents clean water, white represents oxygen and red represents food.
2. Have the students stand arm’s distance apart from one another.
3. Tell the students that one foot must remain in place at all times. This represents the fact that fish have certain living conditions that they require and generally must remain in places with those living conditions. Students are not allowed to slide their foot across the ground and may not take a chip from another “fish” if they already have it in their “fin.”
4. Students may gather only one chip at a time. They may start gathering only when told to start and must stop when told to stop.
5. Scatter the poker chips on the ground around the students so the chips are about 1-2 feet apart.
6. Tell students they will have 30 seconds to gather their survival needs. Tell the students to start. After 30 seconds, tell the students to stop. Have students sort and count their chips.
7. Explain that each fish must get at least two chips of each color in order to survive. Ask students the following questions:
  - How many of their survival needs did each fish get?
  - Do any fish lack a particular requirement?
  - What might happen to a real fish that lacked one of its requirements for survival?
8. Determine which fish survived the first round. Record the survival rate for “Initial Conditions” on the board.
9. Point out that not all fish have the same requirements. Some might survive water that is warmer or has less oxygen or is clouded with silt.
10. Gather the chips both from the ground and from the students.
11. Randomly designate one out of every four students as catfish. Repeats steps 5 and 6.

12. Explain that catfish can survive in water that is warmer or has less oxygen or is clouded with silt. Therefore catfish need to gather only one white chip and one blue chip to survive. (Refer students to Chapter 4.) Ask how many catfish survived this round and compare that to the survival rate among the other fish. Record the survival rates for “Catfish and Other Fish” on the board.
13. Gather the chips both from the ground and from the students. Have them stand together in groups of three to five with one foot touching the other students’ feet. Repeats steps 3–6.
14. Explain that this represents a waterbody that is crowded or that lacks adequate living conditions. Tell students that the living conditions an organism requires are called its habitat.
15. Ask how many catfish and other fish survived. Record the survival rates for “Crowded/Poor Habitat” on the board. Compare the results of this round to those of the previous rounds. In most cases, students will notice that each fish gathered fewer of their survival needs. Ask if they can reach any conclusion about a pond that is overcrowded with fish or has poor habitat.
16. Gather the chips both from the ground and from the students and once again have them stand arm’s distance apart from one another.
17. Explain that excess plant nutrients from cattle manure runoff have caused an increase in plant nutrients in the water. Ask students to predict what will happen. (Algae will grow out of control, use up the nutrients, die and decay. Their decay will use up much of the dissolved oxygen in the water. Refer students to Chapters 1–3.) Take out half of the white chips, representing oxygen and repeats steps 5 and 6. Record the survival rates for “Algae Overgrowth” on the board.
18. Gather the chips both from the ground and from the students.
19. Explain that careless construction in the watershed has caused rapid erosion. Ask students to predict the effect on fish survival. (Sediment entering the water will reduce fish survival. Refer students to Chapters 1–3.) Take out half of the blue clean water chips. Repeats steps 5 and 6. Record the survival rates for “Erosion and Sedimentation” on the board.
20. Gather the chips both from the ground and from the students.
21. Explain that a new predator species has appeared that eats the same food as native fish. Reduce the number of red food chips. Repeats steps 5 and 6. Record the survival rates for “Introduced Species” on the board. Gather the chips both from the ground and from the students.
22. Have students write a science notebook entry reviewing what they learned from the activity.

## Activity 5.3: Student Reading and Research

This activity provides students with definitions and explanations about competition, habitat, niche and carrying capacity within aquatic communities.

### Estimated Time

Varies—class time may be provided or reading may be assigned as homework. Allow at least 20 minutes for in-class questions and discussion.

### Required Materials

- Student Guide
- Notebook paper (optional)
- Pens or pencils (optional)

### Procedure

1. Have students read the first six paragraphs of Chapter 5: From Sun to Sunfish. Introduce vocabulary terms as needed.
2. Assign the first four **Questions to Consider** as homework or use them in a cooperative learning activity. (See Activity 5.5 for **Questions to Consider** 5-7.)
  1. What are some of the basic survival needs of all living things?  
**Most living things require food, water, oxygen, space and shelter or protection from the elements and from enemies to survive and grow. Plants make their own food but need sunlight, carbon dioxide and minerals to do so. Most vertebrates need periodic sleep or rest. Some bacteria don't need oxygen.**
  2. What is a population? What is a community?  
**A group of one kind of organism living in the same place at the same time is a population of that species. Different populations living in the same place interact with one another. A group of populations living in the same place is called a community.**
  3. What is habitat? Why is it important? Why must organisms compete for resources? What is carrying capacity?  
**The physical environment that a species needs to survive is its habitat. Habitat is more than a place. Habitat is the shelter a species uses to escape predators and the elements, as well as the space it needs for reproducing and for hunting, gathering or producing food. It includes all the conditions a species prefers. Many aquatic plants and animals have very specific needs. They either can't move or can't live in another habitat. When resources in an environment are in short supply, individuals and populations must compete for them. Carrying capacity is the maximum number of individuals in a particular population that an environment can support. The limits on biotic (living) and abiotic (non-living) resources determine the environment's carrying capacity.**
  4. What is a niche? Why is it important? What are invasive species? Why are they a problem?  
**A species' niche includes its way of getting food, the habitat it needs and the role it performs in the community. Within a community every species has a particular niche. Different species may have similar or even overlapping habitats, but no two species can occupy exactly the same niche in the same community for long. A species is called invasive if it has been brought (usually by human action) to a place where it did not live naturally. If the invasive species can breed and sustain itself in the new habitat, then it may compete with native species for habitat or food. This competition could make it harder for the native species to survive. Over time, this invasion can unbalance the community. As a result, native species could become endangered.**

## Activity 5.4: Video Introduction of Habitat, Niche, Competition and Non-native Species

This activity helps students understand the concepts of habitat, niche and competition by comparing and contrasting non-native fish species with native Missouri fish species.

### Estimated Time

Varies—class time may be provided or research may be assigned as homework. Allow at least 30 minutes for video clips and in-class questions and discussion.

### Required Materials

- DVD Compilation for *Conserving Missouri's Aquatic Ecosystems*
- Missouri Fishes poster (E00013)
- Know Missouri's Catfish (FIS003)
- Introduction to Missouri Fishes (FIS020)
- *Fishes of Missouri* (01-0031)
- TV/DVD player
- Pens or pencils
- Adhesive tape (e.g., Scotch or cellophane)
- Computer with internet connectivity (optional)
- One copy of Missouri Fish and Their Characteristics page 2 for each student

### Procedure

1. Show the video clips: "Trout Eggs" and "Ozark Rainbows." Lead class discussion comparing and contrasting rainbow trout with some Missouri native fish species.
2. Have students add rainbow trout and its characteristics to the comparison matrix of fish species they started in Activity 4.4.
3. Distribute a blank Missouri Fish and Their Characteristics page 2 comparison matrix to each student. Have students tape it to the Missouri Fish and Their Characteristics comparison matrix in their notebooks, so as to create a fold-out extension.
4. Tell students to investigate the habitat requirements and origin of rainbow trout and their previous fish using video clip, online, in-class or library resources. Class time may be provided or research may be assigned as homework. Have students record their findings by completing columns of the comparison matrix. This matrix will be used (added to) again in later activities.





**Missouri Fish and Their Characteristics, Page 2**

Habitat requirements	Origin



# Activity 5.5: Student Reading and Research

This activity provides students with definitions and explanations about food chains, food webs, energy pyramids, trophic levels and natural selection.

## Estimated Time

Varies—class time may be provided or reading may be assigned as homework. Allow at least 20 minutes for in-class questions and discussion.

## Required Materials

- Student Guide
- Notebook paper (optional)
- Pens or pencils (optional)

## Procedure

1. Have students read the rest of Chapter 5: From Sun to Sunfish. Introduce vocabulary terms as needed.
2. Assign the rest of the **Questions to Consider** as homework or use them in a cooperative learning activity.
  5. What is the source of energy for aquatic communities? How does energy circulate among organisms in an aquatic community?  
**Aquatic communities run on sunlight. Energy circulates among organisms through feeding relationships (they eat one another).**
  6. What is a food chain? What is a food web? What is an energy pyramid? What is a trophic level?  
**A food chain shows how energy moves from producers to primary consumers to secondary consumers and so on. Food webs show how different food chains are interconnected. An energy pyramid is another way to look at feeding relationships. If you divide a pyramid into levels, you can see that the widest one is at the base and the narrowest one is at the top. The pyramid shape not only shows what eats what, but how much energy is available at each consumer level. Consumer levels are also known as trophic levels.**
  7. How do predator and prey species keep one another in balance in aquatic communities? What is natural selection?  
**Both predator and prey are competing against one another for survival; the predator is seeking food, and the prey is trying to keep from being eaten. Predators play an important role by keeping populations of prey species below their carrying capacity. At the same time, the amount of prey available in a predator's habitat can limit the number of predators that can live there. Natural selection is the process of sorting individuals based on their ability to survive and reproduce in their environment. Natural selection ensures that only the best-adapted species survive and reproduce.**

# Activity 5.6: Video Reinforcement of Habitat, Niche, Competition and Non-native Species

This activity helps students understand the concepts of habitat, niche and competition by comparing and contrasting non-native fish species with native Missouri fish species.

## Estimated Time

Varies—class time may be provided or research may be assigned as homework. Allow at least 30 minutes for video clips and in-class questions and discussion.

## Required Materials

- DVD Compilation for *Conserving Missouri's Aquatic Ecosystems*
- Poster: Missouri Fishes (E00013)
- Know Missouri's Catfish (FIS003)
- Introduction to Missouri Fishes (FIS020)
- *Fishes of Missouri* (01-0031)
- TV/DVD player
- Pens or pencils
- Adhesive tape (e.g., Scotch or cellophane)
- Computer with internet connectivity (optional)
- 1 copy of Missouri Fish and Their Characteristics page 3 for each student

## Procedure

1. Show the video clip: "Jumping Carp." Lead class discussion comparing and contrasting silver/bighead carp (treat as a single species) with some Missouri native fish species.
2. Have students add silver/bighead carp and their characteristics to the comparison matrix of fish species they started in Activity 4.4. and continued in Activity 5.4.
3. Distribute a blank Missouri Fish and Their Characteristics page 3 comparison matrix to each student. Have students tape it to the Missouri Fish and Their Characteristics page 2 comparison matrix in their notebooks, so as to create another fold-out extension.
4. Tell students to investigate what silver/bighead carp eat, what eats them and what their trophic level (producer, primary consumer, secondary consumer, scavenger/decomposer) is. Have them do the same for their previous fish using video clip, online, in-class or library resources. Class time may be provided or research may be assigned as homework. Have students record their findings by completing columns of the comparison matrix.

**Missouri Fish and Their Characteristics, Page 3**

<b>What it eats</b>	<b>What eats it</b>	<b>Trophic level</b>



# Activity 5.7: Student Simulation of Food Webs within an Aquatic Community

*Adapted from Aquatic Community Food Web Scramble, by Jack Woodhead and Elaine Callaway, Missouri Department of Conservation*

Students play a simulation game to help them understand the complexity of aquatic food webs.

## Estimated Time

40 minutes

## Required Materials

- *Aquatic Community Food Web Scramble* information card for each species (Advanced preparation is required.)
- *Aquatic Community Food Web Scramble* name tag for each species (Advanced preparation is required.)
- Three 6-foot-long strands of yarn or cord per student (Advanced preparation is required.)

## Procedure

1. This game is designed for groups of 15 to 30 students. If necessary, break students into smaller groups and conduct games simultaneously.
2. Explain to the class that they are going to play a game to illustrate the complexity of aquatic food webs. Tell them the objective of the game is to develop a self-sustaining community beginning with random populations of plant and animal species. After the community is established, various factors will be changed to illustrate the interdependency of the community. Each type of animal or plant listed represents a population of unknown size. The overhead lights represent the sun.
3. Spread the plant and animal nametags on a table.
4. Mix the cards and give each student one card at random, keeping the extra cards.
5. Have each student carefully read his/her entire card to himself/herself, and then pick up the corresponding nametag and three strings.
6. Check to be sure each student understands the information about the plant or animal he/she is playing. Explain terms and concepts as needed. Be sure each student recognizes his/her plant or animal.
7. Divide the students according to the information on the cards into the following groups:
  - Plants—producers
  - Animals that eat only plants—primary consumers or herbivores
  - Animals that eat both plants and animals—secondary consumers or omnivores
  - Animals that eat only other animals—secondary consumers or carnivores
8. Have the plants move to the center of the playing space. Primary consumers surround plants and give one end of a string ( food line) to each type of plant they eat. Students may want to sit on the ground or floor.

## Prepare in advance

- Photocopy species card pages onto cardstock and laminate, then cut on the dotted lines to make playing cards.
- Photocopy species name tag pages onto cardstock and laminate, then cut on the dotted lines to make tags.
- Punch a hole in the upper corners of each tag. Tie the ends of a 3-foot strand of yarn or cord to each hole. Students may hang these around their necks during the game.
- Cut three 6-foot-long strands of yarn or cord per student. Tie or singe the ends of the cords to prevent unraveling. Brightly colored braided nylon string or Mason's chalk line, available at most hardware stores, work well.

9. Animals that eat both plants and animals (secondary consumers or omnivores), and animal eaters (secondary consumers or carnivores) surround plant eaters, giving a food line to each major food they eat. Check to be sure all students have an adequate food supply and calls the group's attention to any inadequacies. Any student with an inadequate food supply steps to the sidelines (dies) for the moment. The group of adequately fed students comprises the community.
10. Discuss the community that has been formed, noting presence or absence of major food sources or plant types, the proportion of plant eaters to animal eaters, etc. Have the class decide whether the community could survive.
11. Make selective substitutions from the extra cards, using students from the sidelines or the community as necessary to produce a well-established community that includes all students. Have students change name tags as well as cards when making substitutions. Have students raise the food lines over their heads and note the complexity and web-like appearance.
12. Explain that each change in the conditions in an area will cause corresponding changes among the community members.
13. When conditions change, those students who are eliminated must step to the sidelines, taking their food lines with them. They may then be assigned a new role to reestablish the community with the new conditions. Discuss each change as it occurs. The following changes have proved effective, but many others are possible.
14. Summer/winter: Most groups will assume summer conditions when beginning. Explain that changing to winter causes great differences due to migration, hibernation, plant dormancy, etc. Photosynthesis continues to occur in aquatic communities as long as sunlight can penetrate the ice layer, but it stops if ice is snow-covered, preventing sunlight from reaching plant-like plankton. Point out the temporary and cyclical nature of these natural changes. Ask students to provide examples of how species have adapted to temporary cyclical changes in conditions.
15. Drought conditions: Explain that low water conditions cause crowding and greater competition for food, less shoreline area, and increased access for terrestrial predators. Extreme drought conditions (i.e., drying up of pond) could eliminate some organisms. Some microscopic species can live in small puddles. Air breathers would travel to other areas or die. Ask students to speculate as to whether these changes would be temporary and cyclical or permanent. Point out the distinction between the death of an individual and the elimination of a population.
16. Watershed development: Tell the class that the surrounding grassland or woodland is being converted to a housing development without proper soil conservation methods. Ask students to predict the results. (Sediment entering the water, possible fertilizer and pesticide pollution from lawns or increased runoff velocities and habitat destruction will alter the community and reduce survival. Refer students to Chapters 1–3.)
17. Cattle in watershed: Tell the class that the surrounding grassland or woodland is being converted to a livestock operation without proper fencing or waste management. Ask students to predict the results. (Increased pollution from cattle wastes may cause algae overgrowth and fish kills. Sediment entering the water from cattle trampling the banks and stirring up the mud bottom increases turbidity and reduces photosynthesis. There are few if any shoreline plants. All these will alter the community and reduce survival. Refer students to Chapters 1–3.)
18. Herbicide use: Tell the class that herbicide is being used to control weeds in the watershed. Ask students to predict the results. (Depending on the type of herbicide, aquatic plants could be destroyed, which could completely destroy the food chain. Refer students to Chapters 1–3.) This is one way to end the game.
19. Have students write a science notebook entry reviewing what they learned from the activity.



# Information cards

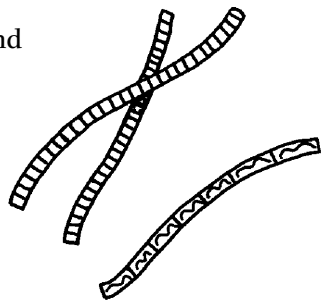
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## ALGAE

**Producer:** Many varieties found in ponds

**Predators:** Animals that eat aquatic plants

**Habitat:** Along shoreline and in open water; must have sunlight to produce food. Along with other plants, algae are the first link in the food chain.



## BACKSWIMMER

**Foods:** This fierce predator eats other insects, invertebrates and sometimes small fish.

**Predators:** Fish, frogs, birds

**Habitat:** Hanging from surface of the water; on or among the plants; occasionally free-swimming

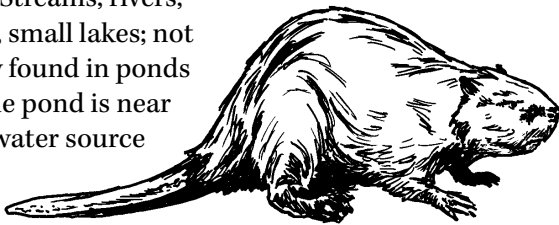


## BEAVER

**Foods:** Bark and twigs of shoreline trees. Summer foods include water lilies, pondweeds and cattails.

**Predators:** Coyotes, bobcat, otters, minks and—most importantly—humans

**Habitat:** Streams, rivers, marshes, small lakes; not normally found in ponds unless the pond is near a larger water source



## BELTED KINGFISHER

**Foods:** Mostly fish, some insects, frogs, lizards

**Predators:** Raccoons, snakes. Skunks prey on young and eggs.

**Habitat:** Nests in banks near pond; hovers over water or sits on overhanging branches

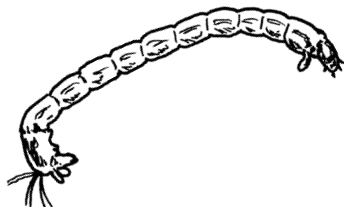


## BLOODWORMS

**Foods:** Plankton, detritus

**Predators:** Large and small fish

**Habitat:** Bottom sediments of pond; not really a worm but the larva of a midge-fly

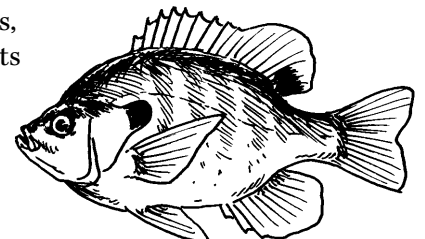


## BLUEGILL

**Foods:** Mayflies and other insects, crustaceans, small fish, crayfish, snails; algae when animal foods are scarce

**Predators:** Bass and other fish, snapping turtles, herons, osprey; adults prized by humans

**Habitat:** Open water or along shoreline where food is abundant



## BULLFROG

**Foods:** Any small animal it can catch and swallow whole, including insects, crayfish, small snakes, minnows, other frogs

**Predators:** Any meat-eater that can catch and eat it, such as snakes, herons, fish, raccoons, humans

**Habitat:** Shores of lakes, ponds, streams



## CADDISFLY LARVA

**Foods:** Small crustaceans, insects, worms, diatoms, algae. Some species are entirely predacious.

**Predators:** Fish, diving beetles, giant water bugs

**Habitat:** Submerged stems of plants in shallow water; stream bottoms in riffles. They construct a tube-like shell from bits of plants or sand particles.

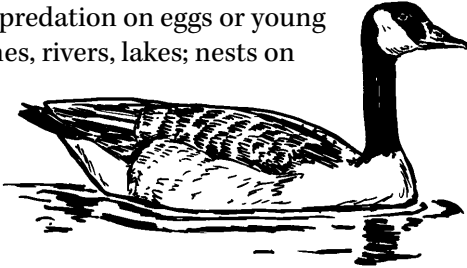


## CANADA GOOSE

**Foods:** Wetland grasses, grains, sedges, roots of water plants

**Predators:** Fox, raccoons, coyotes, bobcat, humans; most predation on eggs or young

**Habitat:** Marshes, rivers, lakes; nests on ground; defends nest vigorously

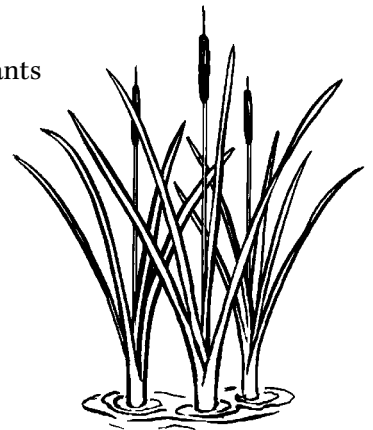


## CATTAILS

**Producer:** Tall, erect plants with long leaves and usually a green or brown head

**Predators:** Aphids, caterpillars, moths, beetles, birds, small mammals

**Habitat:** Rooted along shoreline

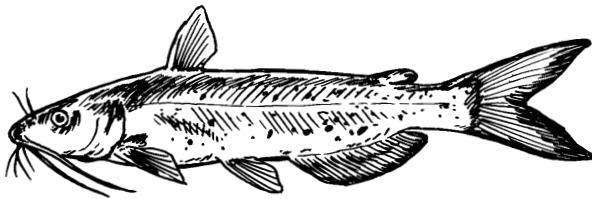


## CHANNEL CATFISH

**Foods:** Fish, insects, crayfish, mollusks, plants

**Predators:** Young are eaten by other fish. Adults are prized by anglers.

**Habitat:** Open water or bottom of ponds where they have been stocked

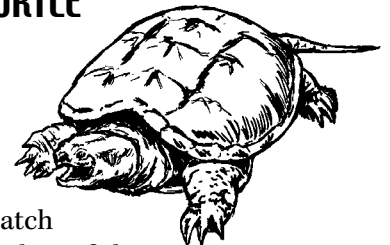


## COMMON SNAPPING TURTLE

**Foods:** Insects, crayfish, fish, snails, earthworms, amphibians, snakes, small mammals, birds, aquatic plants

**Predators:** Few. Humans catch adult turtles for their meat; large fish eat young; snakes or raccoons or other mammals eat eggs; sometimes the turtles are hosts to leeches.

**Habitat:** Prefer ponds with muddy bottoms, submerged logs and snags and lots of plants

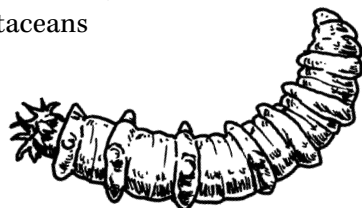


## CRANEFLY

**Foods:** Larvae can be either predacious on worms or insects, or herbivorous, depending on species. Some adults feed on nectar, but many do not eat at all.

**Predators:** Birds. If near water, fish eat adults. Fish and crustaceans eat larva.

**Habitat:** Wet moss and other plants along shoreline

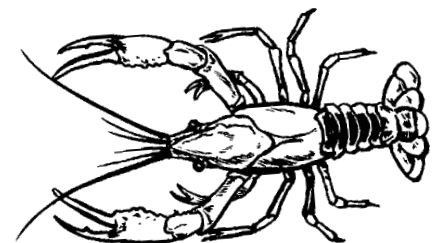


## CRAYFISH

**Foods:** Both plants and animals. Sometimes crayfish are predators, and sometimes they act as scavengers.

**Predators:** Raccoons, otters, fish, wading birds, frogs, turtles. Some people consider crayfish a delicacy.

**Habitat:** Ponds and streams; sometimes in burrows or under logs or plants

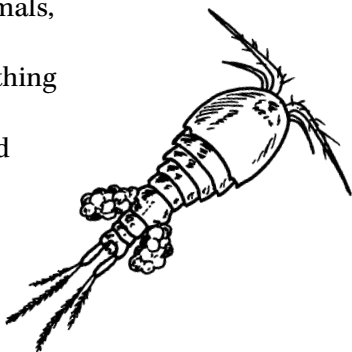


## CYCLOPS

**Foods:** Microscopic animals, algae, detritus

**Predators:** Nearly everything that eats plankton

**Habitat:** Open water and shallow water of ponds

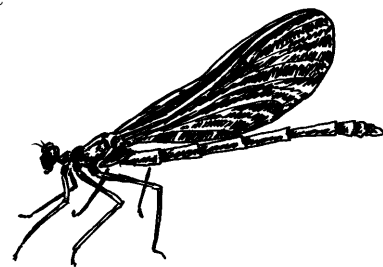


## DAMSELFLY ADULT

**Foods:** Mosquitoes, flies, other insects

**Predators:** Fish, birds

**Habitat:** Plants that grow up and stick out from the water; open air over pond

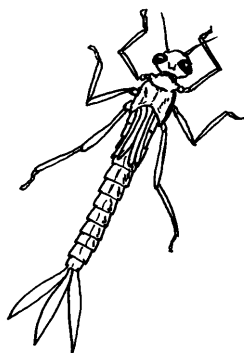


## DAMSELFLY NYMPH

**Foods:** Insect larvae, worms, small crustaceans; occasionally small fish and tadpoles

**Predators:** Fish, larger insects, crustaceans

**Habitat:** Hides among algae and other plants along the shoreline



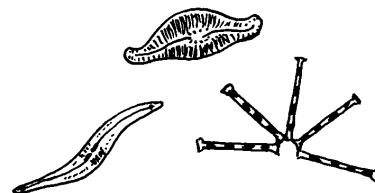
## DIATOMS

**Producer:** Microscopic algae

**Predators:** Insects, fish, microscopic animals.

Diatoms are a major part of the plant-like plankton, which is the basic food source for all consumers.

**Habitat:** Free-floating or suspended in open water



## DIVING BEETLE

**Foods:** Caddisfly larva, or any small animal they can capture. Diving beetles are ferocious predators with large jaws that eat other insects.

**Predators:** Reptiles, amphibians, fish, wading birds, raccoons, skunks

**Habitat:** Usually in weedy shallows along shoreline.

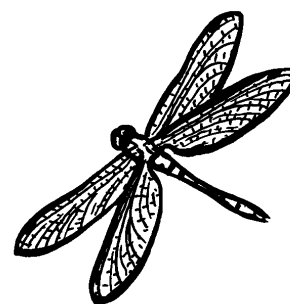


## DRAGONFLY ADULT

**Foods:** Mosquitoes, flies, other insects

**Predators:** Birds, fish

**Habitat:** Plants that grow up and stick out from the water; open air over pond

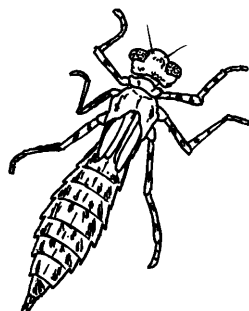


## DRAGONFLY NYMPH

**Foods:** Insect larvae, worms, small crustaceans; occasionally small fish and tadpoles

**Predators:** Fish, larger insects, crustaceans

**Habitat:** Hides among algae and other plants along the shoreline

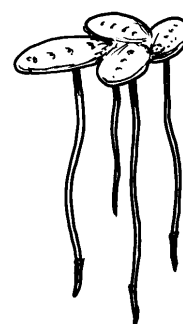


## DUCKWEED

**Producer:** Small, single-leafed floating plant; rootlets dangle in water

**Predators:** Flatworms, insect larvae, ducks, geese

**Habitat:** Free-floating on pond surface

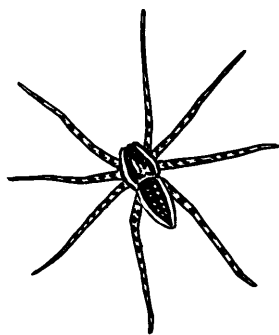


## FISHING SPIDER

**Foods:** Mostly insects; occasionally small fish and tadpoles

**Predators:** Snakes, frogs, some birds

**Habitat:** Surface of pond in dense aquatic plants

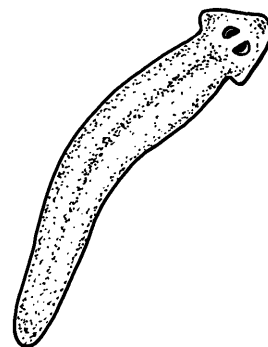


## FLATWORM (Planaria)

**Foods:** Small animals; living or dead protozoans or nematodes

**Predators:** Worms, insects, crustaceans

**Habitat:** Under stones and submerged leaves in dark areas

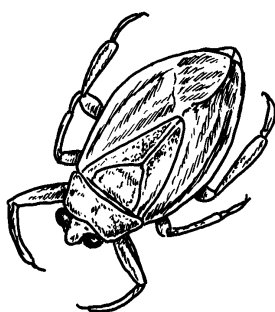


## GIANT WATER BUG

**Foods:** Fiercely predacious, attacking insects, crustaceans and even tadpoles, frogs and fish several times their size

**Predators:** Fish, frogs, shorebirds

**Habitat:** Hanging from surface of the water; on or among the plants; occasionally free-swimming

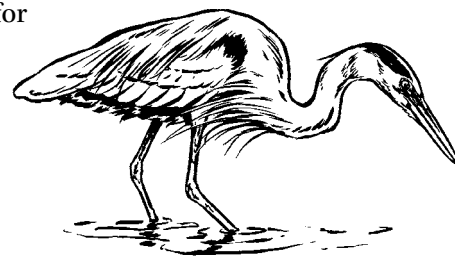


## GREAT BLUE HERON

**Foods:** Mostly small fish, limited numbers of frogs, crayfish, insects and mice

**Predators:** Fox, coyotes, bobcat; too large for most predators

**Habitat:** Marsh, river, lakes; nest in colonies in tops of large, stream-side trees

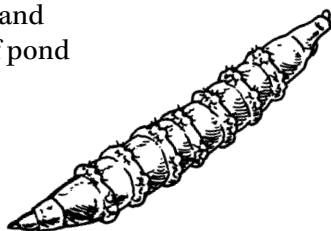


## HORSEFLY LARVA

**Foods:** Worms, snails, other small insects in the water

**Predators:** Fish, birds

**Habitat:** Among plants and along bottom at edge of pond

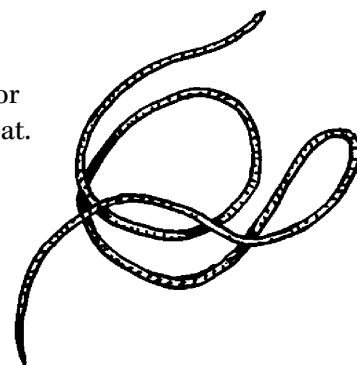


## HORSEHAIR WORMS

**Foods:** Immature are parasites on various crustaceans, mollusks or insects. Adults do not eat.

**Predators:** Fish, giant water bugs

**Habitat:** Quiet water

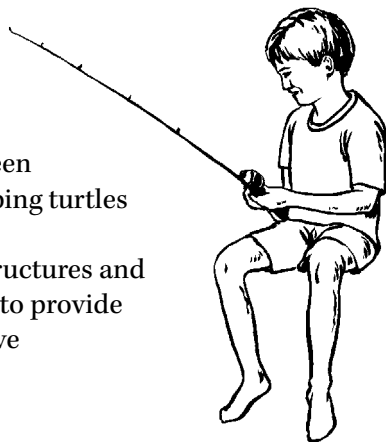


## HUMANS

**Foods:** Bass, bluegill, channel catfish, bullfrog, green frog, crayfish, snapping turtles

**Predators:** None

**Habitat:** Designs structures and alters environment to provide suitable places to live

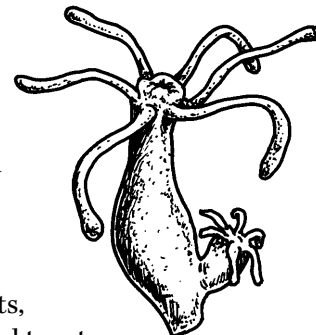


## HYDRA

**Foods:** Tiny (microscopic) animals are trapped in its stinging tentacles. Also, small crustaceans, insects, small clams and fish, seed shrimp, water fleas

**Predators:** Carnivorous insects, water beetles, recently hatched trout

**Habitat:** Attached to twigs or other plants at the bottom of ponds

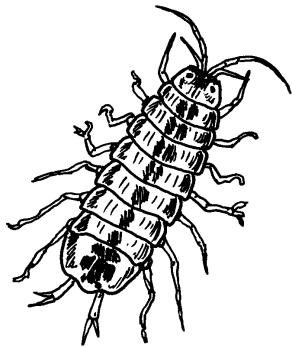


## ISOPODS (Sowbugs)

**Foods:** Detritus; decaying plants on the bottom

**Predators:** They have few predators and are seldom eaten by fish. Some are intermediate hosts for nematodes of fish, birds and amphibians.

**Habitat:** Bottom dwellers able to stand acidic water. Some species prefer clear, cold water; all hide beneath rock and other debris.

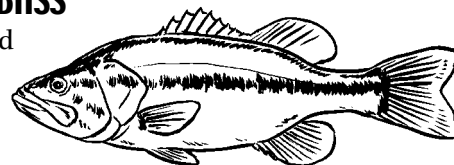


## LARGEMOUTH BASS

**Foods:** Adults feed on fish, crayfish, frogs and large insects. Young feed on daphnia and other small crustaceans.

**Predators:** Snapping turtles, herons. Small fish are eaten by larger fish. Anglers prize large fish.

**Habitat:** Open water or along edge where food supply is abundant.

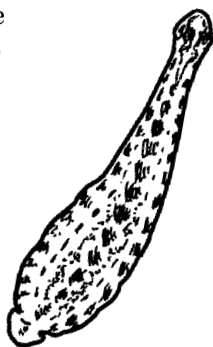


## LEECH

**Foods:** Parasite that feeds on the blood of animals. Most attach to fish, turtles, frogs, snails, insect larvae and worms.

**Predators:** Fish

**Habitat:** Bottom dwellers

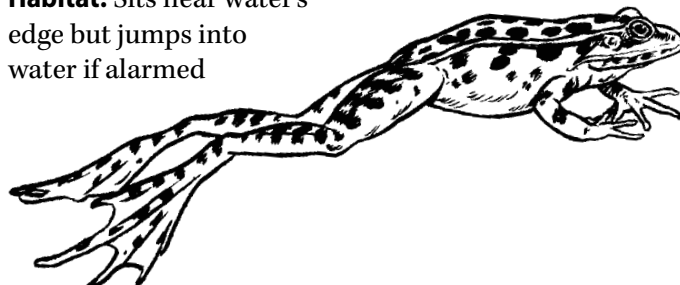


## LEOPARD FROG

**Foods:** Insects, spiders, other invertebrates

**Predators:** Raccoons, snakes

**Habitat:** Sits near water's edge but jumps into water if alarmed



## MALLARD DUCK

**Foods:** Smartweed, corn, acorns, seeds of many water plants, some aquatic invertebrates

**Predators:** Fox, coyotes, bobcat, mink, humans, raccoon, skunk

**Habitat:** Marsh, lakes, rivers; nests on ground

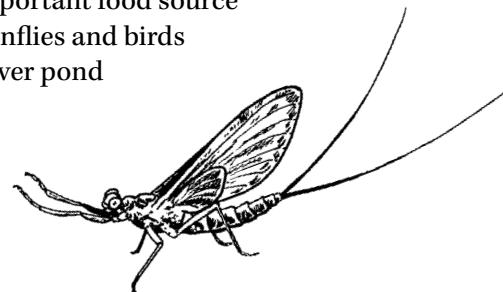


## MAYFLY ADULT

**Foods:** Adults do not eat at all. They live long enough to reproduce, which may only be a few hours.

**Predators:** Important food source for fish, dragonflies and birds

**Habitat:** Air over pond



## MAYFLY LARVA

**Foods:** Small plants, animals, organic debris, diatoms

**Predators:** Important food source for fish and other insect-eaters such as dragonfly larva and beetles

**Habitat:** Various species burrow, live on the bottom or are free-swimming among aquatic plants.

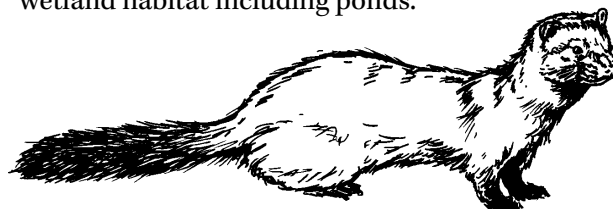


## MINK

**Foods:** Rabbits, muskrats, other small mammals, birds, fish, crayfish, frogs, crustaceans, insects

**Predators:** Humans, dogs, foxes, owls, coyotes, bobcats

**Habitat:** These excellent swimmers live in or near wetland habitat including ponds.



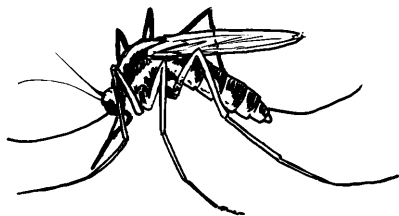


## MOSQUITO ADULT

**Foods:** Females suck mammal blood; males feed on plant juices, if they eat at all.

**Predators:** Dragonflies, damselflies, other insects, birds, frogs, fish, bats

**Habitat:** Air over water and surrounding areas

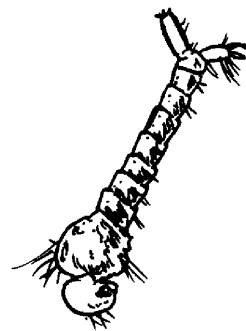


## MOSQUITO LARVA

**Foods:** Tiny plants and animals suspended in the water

**Predators:** Fish, other insects

**Habitat:** Mostly on the water's surface, but dive and hide if threatened

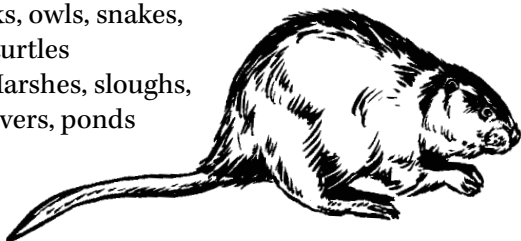


## MUSKRAT

**Food:** Roots, bulbs and foliage of cattails, pondweeds, rushes and wild rice; will eat fish, frogs and insects if plants are not available

**Predators:** Minks, humans, large hawks, owls, snakes, snapping turtles

**Habitat:** Marshes, sloughs, streams, rivers, ponds and lakes

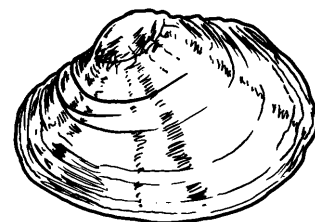


## MUSSELS

**Foods:** Small bits of organic matter suspended in the water. Because they eat small bits of animal matter, they are considered scavengers

**Predators:** Fish, muskrats, mink, otters, raccoons; turtles that are able to open the shells or eat the smaller mussels

**Habitat:** On the bottom of ponds and streams

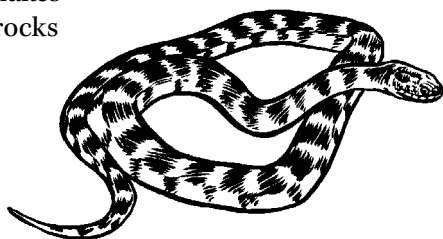


## NORTHERN WATER SNAKE

**Foods:** Crayfish, frogs, tadpoles, small fish, worms, insects

**Predators:** Hawks, owls; large game fish eat young snakes

**Habitat:** Under rocks or debris near shore of ponds, lakes, streams and rivers



## PONDWEEDS

**Producers:** Aquatic seed plants

**Predators:** Birds, muskrats, beaver, deer

**Habitat:** Rooted near shoreline



## RACCOON

**Foods:** Wide variety of small animals, insects, fruits, seeds, garbage, crayfish, frogs, some fish

**Predators:** Few as adults. Humans and large meat-eaters take some young.

**Habitat:** Forest and forest edge; night time visitor to ponds and streams



## RED-WINGED BLACKBIRD

**Foods:** Insects, seeds

**Predators:** Few. Raccoons and snakes will eat eggs.

**Habitat:** Nest in cattails; migrate in winter

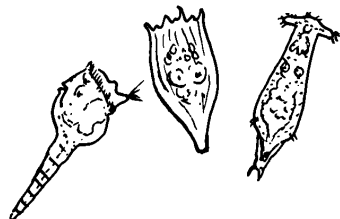


## ROTIFERS

**Foods:** Microscopic plants and animals

**Predators:** Worms, crustaceans

**Habitat:** Near shoreline and around aquatic plants; some occur in open water

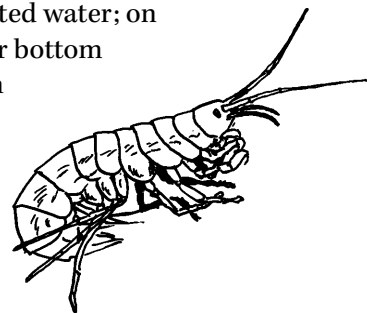


## SCUDS

**Foods:** Scavengers on plant and animal debris

**Predators:** Birds, fish, insects, amphibians

**Habitat:** Clear, unpolluted water; on and among plants; near bottom of pond where they can avoid light

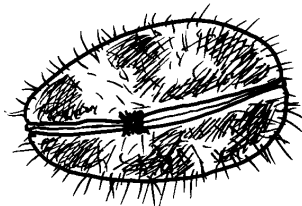


## SEED SHRIMP (Ostracods)

**Foods:** Bacteria, mold, algae

**Predators:** Important food source of small fishes

**Habitat:** On and just above the bottom of ponds; they look like microscopic clams

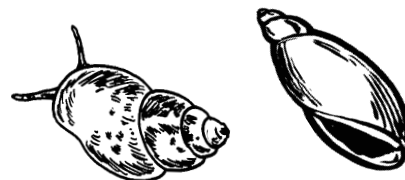


## SNAILS

**Foods:** Algae, other plants, dead plant and animal material

**Predators:** Many kinds of fish, turtles, some birds

**Habitat:** Pond bottom, or on plants and dead material in ponds



## SPRINGTAIL

**Foods:** Decaying plant and animal material; occasionally some living plant material

**Predators:** Fish, spiders, frogs, other animals that eat insects

**Habitat:** Surface of the pond in quiet backwaters. They hibernate but are among first signs of animal life in the spring.



## STONEFLY NYMPH

**Foods:** Dead plant material; detritus and fine organic particles and the algae, bacteria and fungi living on detritus.

As they grow larger they become predators of other invertebrates.

**Predators:** Fish, other predaceous invertebrates, amphibians

**Habitat:** Only found in cool, well-oxygenated flowing waters (very sensitive to pollution); crawl about in rocks, gravel and debris on stream bottom

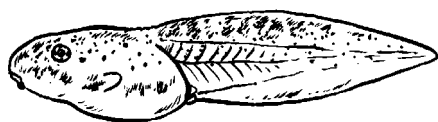


## TADPOLES

**Foods:** Submerged oozes and scums containing small plants and animals; algae, diatoms, desmids, decaying plants

**Predators:** Fish, snakes, giant water bugs. Some predacious insects eat the small tadpoles.

**Habitat:** In shallow areas near the water's edge

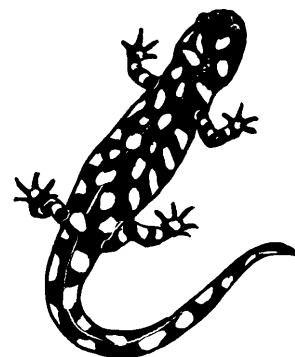


## TIGER SALAMANDER

**Foods:** Earthworms, insects, spiders, slugs, snails

**Predators:** Fishes, snakes, snapping turtles, some birds and mammals

**Habitat:** In burrows under logs and rocks near water; active only at night



## WATER BOATMAN

**Foods:** Algae and decaying plants; sometimes dive to feed on decaying animal material on the bottom; sometimes mosquito larvae

**Predators:** Fish

**Habitat:** Surface of pond, sometimes diving to find food; must cling to something to stay under water surface

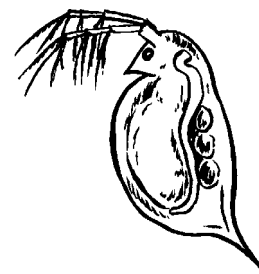


## WATER FLEA (Daphnia)

**Foods:** Filter plankton from the water; algae; organic debris

**Predators:** Hydras, insects, fish, some rotifers

**Habitat:** Weedy margins of ponds, abundant in all types of water except fast streams and polluted water

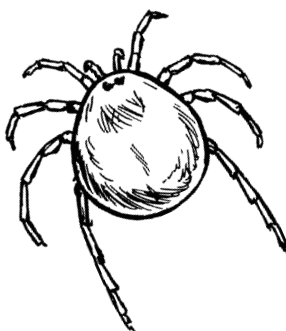


## WATER MITES

**Foods:** Insects, worms. Some are parasitic.

**Predators:** Hydras, insect, fish

**Habitat:** Creep on bottom and on plants

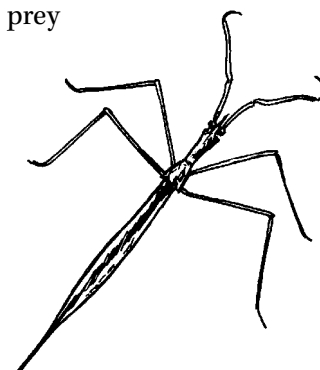


## WATER SCORPION

**Foods:** Small insects; seize prey with powerful forelegs similar to preying mantis

**Predators:** Animals that eat insects

**Habitat:** Ponds and weedy sections of lakes and streams; hides just under the surface among plants; long breathing tube at rear

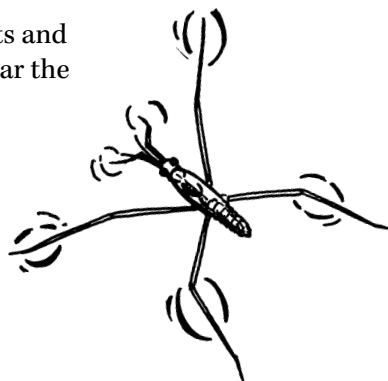


## WATER STRIDER

**Foods:** Prey on insects and small crustaceans near the surface

**Predators:** Some fish and birds

**Habitat:** Surface of water; often seen "skating" over the surface in search of food

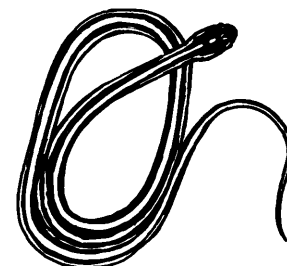


## WESTERN RIBBON SNAKE

**Foods:** Worms, fish, tadpoles, frogs, toads, salamanders, mice, sometimes other small snakes

**Predators:** Hawks, owls, snapping turtles, herons. Some fish eat small snakes.

**Habitat:** Near water, ponds, swamps, marshes, sloughs, streams and rivers

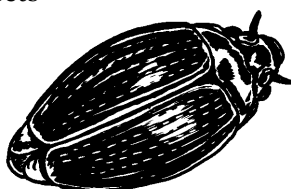


## WHIRLIGIG BEETLE

**Foods:** Whirl in circles collecting insects and organic debris at the surface

**Predators:** Fish, birds, frogs, snakes and other animals that eat insects

**Habitat:** On the surface, often among plants; eyes are divided and can see above and below water at same time





**ALGAE**

**BACKSWIMMER**

**BEAVER**

**BELTED  
KINGFISHER**

**BLOODWORMS**

**BLUEGILL**

**BULLFROG**

**CADDISFLY  
LARVA**

**CANADA GOOSE**

**CATTAILS**

**CHANNEL  
CATFISH**

**COMMON  
SNAPPING  
TURTLE**

**CRANEFLY**

**CRAYFISH**

**CYCLOPS**

**DAMSELFLY  
ADULT**

**DAMSELFLY  
NYMPH**

**DIATOMS**

**DIVING BEETLE**

**DRAGONFLY  
ADULT**

**DRAGONFLY  
NYMPH**

**DUCKWEED**

**FISHING SPIDER**

**FLATWORM**  
**(Planaria)**

**GIANT WATER  
BUG**

**GREAT BLUE  
HERON**

**HORSEFLY  
LARVA**

**HORSEHAIR  
WORMS**

**HUMANS**

**HYDRA**

**ISOPODS**  
**(Sowbugs)**

**LARGEMOUTH**  
**BASS**

**LEECH**

**LEOPARD FROG**

**MALLARD DUCK**

**MAYFLY ADULT**

**MAYFLY LARVA**

**MINK**

**MOSQUITO  
ADULT**

**MOSQUITO  
LARVA**

**MUSKRAT**

**MUSSELS**

**NORTHERN  
WATER SNAKE**

**PONDWEEDS**

**RACCOON**

**RED-WINGED  
BLACKBIRD**

**ROTIFERS**

**SCUDS**

**SEED SHRIMP  
(Ostracods)**

**SNAILS**

**SPRINGTAIL**

**STONEFLY  
NYMPH**

**TADPOLES**

**TIGER  
SALAMANDER**

**WATER  
BOATMAN**

**WATER FLEA  
(Daphnia)**

**WATER MITES**

**WATER  
SCORPION**

**WATER  
STRIDER**

**WESTERN  
RIBBON SNAKE**

**WHIRLIGIG  
BEETLE**



# Activity 5.8: Student Investigation of Missouri Aquatic Animals

Students apply what they have learned in the preceding activities to create a data table to record observations about other aquatic animals in preparation for their field study day.

## Estimated Time

35 minutes

## Required Materials

- DVD Compilation for *Conserving Missouri's Aquatic Ecosystems*
- TV/DVD player
- Pens or pencils

## Procedure

1. Show the video clip: "St. Francis Crayfish." Lead class discussion about niche, competition and natural selection.
2. Instruct students to work in teams to decide the best way to record observations about other aquatic animals as part of their field study day. Remind them to consider not only direct visual observation, but auditory observation and indirect signs of animal activity such as tracks, scat, nests, burrows, chewed stems and worn paths.
3. Have each team create a data table and have each student make a copy for his/her notebook.



# Chapter 5 Assessment

## Directions

Select the best answer for each of the following multiple-choice questions.

1. Complete this analogy: Individual is to population as
  - a. Water is to surface tension.
  - b. Fish is to gills.
  - c. Niche is to habitat.
  - d. Population is to community.
2. Which of the following statements about competition is true?
  - a. Individuals within a population may compete with other individuals of the same species.
  - b. Individuals within a population may compete with individuals of different species.
  - c. A population within a community may compete with other populations within the community.
  - d. All of the above
3. Complete this analogy: Habitat is to niche as
  - a. Feeding habit is to niche.
  - b. Producer is to consumer.
  - c. Niche is to habitat.
  - d. All of the above
4. Carrying capacity is the result of which of the following:
  - a. Different populations living in the same place interact with one another.
  - b. Within a community every species has a particular niche.
  - c. While living organisms have the capacity to produce populations of infinite size, environments and resources are limited.
  - d. Most energy pyramids can continue for only four or five trophic levels and can support only a few top-level consumers.
5. Complete this analogy: Habitat is to gravel-bottomed stream as \_\_\_\_\_ is to insect-eating predator.
  - a. Algae
  - b. Trophic level
  - c. Niche
  - d. None of the above
6. Which of the following statements about invasive species is true?
  - a. The invasive species may compete with native species for habitat or food.
  - b. Invasive species are not subject to natural selection.
  - c. Invasive species play an important role by keeping populations of prey species below their carrying capacity.
  - d. None of the above
7. Complete this analogy: Sunlight is to food web as
  - a. Food source is to niche.
  - b. Producer is to consumer.
  - c. Niche is to habitat.
  - d. None of the above
8. What is the biggest threat to aquatic communities?
  - a. Predator/prey relationships
  - b. Natural selection
  - c. Human-caused habitat destruction
  - d. All of the above
9. Complete this analogy: Competition is to \_\_\_\_\_ as \_\_\_\_\_ is to food webs.
  - a. Competitor; decomposer
  - b. Natural selection; sunlight
  - c. Prey; consumer
  - d. None of the above
10. Why can most energy pyramids continue for only four or five trophic levels and support only a few top-level consumers?
  - a. Most of the available food energy is lost moving up each trophic level.
  - b. Animals lose energy doing tasks such as hunting and keeping their bodies warm.
  - c. Only a little of the sun's energy passes from one trophic level to the next.
  - d. All of the above

# Chapter 5 Assessment

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## Directions

Write your own answer for each of the following questions.

1. Create an imaginary aquatic community capable of existing in Missouri with populations of at least two examples of each of the following: producers, consumers and decomposers/scavengers. Specify producers by placing them in rectangles, consumers in circles and scavengers/decomposers in triangles. Draw (or diagram) and describe the transfer of energy within the community. Use the back of this page.
2. Create a graphic organizer to specify which populations of organisms within your community (above) compete with one another, and for what resources.
3. Predict the outcome in the community if one of the populations (you choose which) were completely removed from the community.

# Chapter 5 Assessment Answer Key

## Multiple-choice questions

1. Complete this analogy: Individual is to population as  
**d. Population is to community.**
2. Which of the following statements about competition is true?  
**d. All of the above**
3. Complete this analogy: Habitat is to niche as  
**a. Feeding habit is to niche.**
4. Carrying capacity is the result of the fact that:  
**c. While living organisms have the capacity to produce populations of infinite size, environments and resources are limited.**
5. Complete this analogy: Habitat is to gravel-bottomed stream as \_\_\_\_\_ is to insect-eating predator.  
**c. Niche**
6. Which of the following statements about invasive species is true?  
**a. The invasive species may compete with native species for habitat or food.**
7. Complete this analogy: Sunlight is to food web as  
**d. None of the above**
8. What is the biggest threat to aquatic communities?  
**c. Human-caused habitat destruction**
9. Complete this analogy: Competition is to \_\_\_\_\_ as \_\_\_\_\_ is to food webs.  
**b. Natural selection; sunlight**
10. Why can most energy pyramids continue for only four or five trophic levels and support only a few top-level consumers?  
**d. All of the above**

## Write-in questions

1. Create an imaginary aquatic community capable of existing in Missouri with populations of at least two examples of each of the following: producers, consumers and decomposers/scavengers. Specify producers by placing them in rectangles, consumers in circles and scavengers/decomposers in triangles. Draw (or diagram) and describe the transfer of energy within the community. Use the back of this page.

**Many answers are possible.**

*Instructors may wish to refer FIG. 5.3 in the Student Guide for an example.*

2. Create a graphic organizer to specify which populations of organisms within your community (above) compete with one another, and for what resources.

**Many answers are possible, but may resemble the following example:**

Population	Competitors	Resource competed for
Algae	Duckweed	Sunlight, water, nutrients
Duckweed	Algae	Sunlight, water, nutrients
Caddisfly larva	Crayfish Largemouth bass	Food Survival (to not be eaten)
Largemouth bass	Crayfish	Food (eats crayfish)
Crayfish	Caddisfly larva Largemouth bass	Food Survival (to not be eaten)
Bacteria	None	None

3. Predict the outcome in the community if one of the populations (you choose which) were completely removed from the community.

**Many answers are possible.**

*Instructors may wish to refer to Chapter 5, paragraph 11, in the Student Guide for an example.*

# Enrichments

## Project WET:

- Water Address

## Project WILD Aquatic:

- Aquatic Times
- Designing a Habitat
- Migration Headache

## Guest speakers:

- Fisheries biologist. If invited for Activities 5.4 or 5.6, the speaker may be able to assist with instruction as well as talk about fisheries management and aquatic communities.
- Hatchery worker. If invited for Activity 5.4, the speaker may be able to assist with instruction as well as talk about hatchery spawning and aquatic communities.

## Additional enrichments:

- Students keep a classroom aquarium.
- Students perform actual or virtual fish dissection.
- Fish maze (dichotomous key)